



# STGF10NB60SD

N-CHANNEL 10A - 600V TO-220FP

PowerMESH™ IGBT

TYPE	V <sub>CES</sub>	V <sub>CE(sat)</sub> (Max) @ 25°C	I <sub>C</sub> @ 100°C
STGF10NB60SD	600	< 1.8 V	10 A

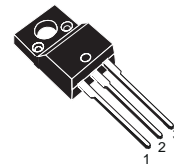
- HIGHT INPUT IMPEDANCE (VOLTAGE DRIVEN)
- LOW ON-VOLTAGE DROP
- HIGH CURRENT CAPABILITY
- OFF LOSSES INCLUDE TAIL CURRENT
- CO-PACKAGED WITH TURBOSWITCH™ ANTIPARALLEL DIODE

## DESCRIPTION

Using the latest high voltage technology based on a patented strip layout, STMicroelectronics has designed an advanced family of IGBTs, the PowerMESH™ IGBTs, with outstanding performances. The suffix "S" identifies a family optimized achieve minimum on-voltage drop for low frequency applications (<1kHz).

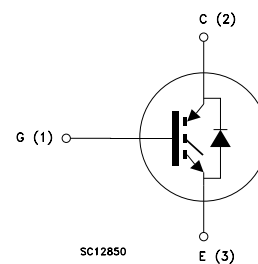
## APPLICATIONS

- LIGHT DIMMER
- STATIC RELAYS
- MOTOR CONTROL



TO-220FP

## INTERNAL SCHEMATIC DIAGRAM



## ABSOLUTE MAXIMUM RATINGS

Symbol	Parameter	Value	Unit
V <sub>CES</sub>	Collector-Emitter Voltage (V <sub>GS</sub> = 0)	600	V
V <sub>ECR</sub>	Reverse Battery Protection	20	V
V <sub>GE</sub>	Gate-Emitter Voltage	± 20	V
I <sub>C</sub>	Collector Current (continuous) at T <sub>C</sub> = 25°C	20	A
I <sub>C</sub>	Collector Current (continuous) at T <sub>C</sub> = 100°C	10	A
I <sub>CM</sub> (●)	Collector Current (pulsed)	80	A
P <sub>TOT</sub>	Total Dissipation at T <sub>C</sub> = 25°C	25	W
	Derating Factor	0.2	W/°C
V <sub>ISO</sub>	Insulation Withstand Voltage A.C. (t = 1 sec; T <sub>C</sub> = 25°C)	2500	V
T <sub>stg</sub>	Storage Temperature	-65 to 150	°C
T <sub>j</sub>	Max. Operating Junction Temperature	150	°C

(●) Pulse width limited by safe operating area

## STGF10NB60SD

### THERMAL DATA

Rthj-case	Thermal Resistance Junction-case Max	5	°C/W
Rthj-amb	Thermal Resistance Junction-ambient Max	62.5	°C/W

### ELECTRICAL CHARACTERISTICS (T<sub>CASE</sub> = 25 °C UNLESS OTHERWISE SPECIFIED)

OFF

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
V <sub>BR(CES)</sub>	Collector-Emitter Break-down Voltage	I <sub>C</sub> = 250 µA, V <sub>GE</sub> = 0,	600			V
V <sub>BR(CES)</sub>	Emitter Collector Break-down Voltage	I <sub>C</sub> = 1 mA, V <sub>GE</sub> = 0,	20			V
I <sub>CES</sub>	Collector cut-off Current (V <sub>GE</sub> = 0)	V <sub>CE</sub> = Max Rating, T <sub>j</sub> = 25 °C V <sub>CE</sub> = Max Rating, T <sub>j</sub> = 125 °C			10 100	µA µA
I <sub>GES</sub>	Gate-Emitter Leakage Current (V <sub>CE</sub> = 0)	V <sub>GE</sub> = ± 20V, V <sub>CE</sub> = 0			± 100	nA

ON (1)

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
V <sub>GE(th)</sub>	Gate Threshold Voltage	V <sub>CE</sub> = V <sub>GE</sub> , I <sub>C</sub> = 250µA	2.5		5	V
V <sub>CE(SAT)</sub>	Collector-Emitter Saturation Voltage	V <sub>GE</sub> = 15V, I <sub>C</sub> = 5 A, T <sub>j</sub> = 25°C V <sub>GE</sub> = 15V, I <sub>C</sub> = 10 A, T <sub>j</sub> = 25°C V <sub>GE</sub> = 15V, I <sub>C</sub> = 10 A, T <sub>j</sub> = 125°C		1.15 1.35 1.25	1.8	V V V

### DYNAMIC

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
g <sub>fs</sub>	Forward Transconductance	V <sub>CE</sub> = 25 V, I <sub>C</sub> = 10 A	5			S
C <sub>ies</sub> C <sub>oes</sub> C <sub>res</sub>	Input Capacitance Output Capacitance Reverse Transfer Capacitance	V <sub>CE</sub> = 25V, f = 1 MHz, V <sub>GE</sub> = 0		610 65 12		pF pF pF
Q <sub>g</sub>	Gate Charge	V <sub>CE</sub> = 400V, I <sub>C</sub> = 10 A, V <sub>GE</sub> = 15V		33		nC
I <sub>CL</sub>	Latching Current	V <sub>clamp</sub> = 480V, R <sub>G</sub> = 1kΩ, T <sub>j</sub> = 125°C	20			A

## SWITCHING ON

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$	Turn-on Delay Time	$V_{CC} = 480\text{ V}$ , $I_C = 10\text{ A}$ $R_G = 1\text{ K}\Omega$ , $V_{GE} = 15\text{ V}$		0.7		$\mu\text{s}$
$t_r$	Rise Time			0.46		$\mu\text{s}$
$(di/dt)_{on}$	Turn-on Current Slope	$V_{CC} = 480\text{ V}$ , $I_C = 10\text{ A}$ $R_G = 1\text{ K}\Omega$ , $V_{GE} = 15\text{ V}$		8		$\text{A}/\mu\text{s}$
$E_{on}$	Turn-on Switching Losses			0.6		$\text{mJ}$

## SWITCHING OFF

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$t_c$	Cross-over Time	$V_{clamp} = 480\text{ V}$ , $I_C = 10\text{ A}$ , $R_{GE} = 1\text{ K}\Omega$ , $V_{GE} = 15\text{ V}$		2.2		$\mu\text{s}$
$t_r(V_{off})$	Off Voltage Rise Time			1.2		$\mu\text{s}$
$t_f$	Fall Time			1.2		$\mu\text{s}$
$E_{off}(^{**})$	Turn-off Switching Loss			5.0		$\text{mJ}$
$t_c$	Cross-over Time	$V_{clamp} = 480\text{ V}$ , $I_C = 10\text{ A}$ , $R_{GE} = 1\text{ K}\Omega$ , $V_{GE} = 15\text{ V}$ $T_j = 125\text{ }^\circ\text{C}$		3.8		$\mu\text{s}$
$t_r(V_{off})$	Off Voltage Rise Time			1.2		$\mu\text{s}$
$t_f$	Fall Time			1.9		$\mu\text{s}$
$E_{off}(^{**})$	Turn-off Switching Loss			8.0		$\text{mJ}$

## COLLECTOR-EMITTER DIODE

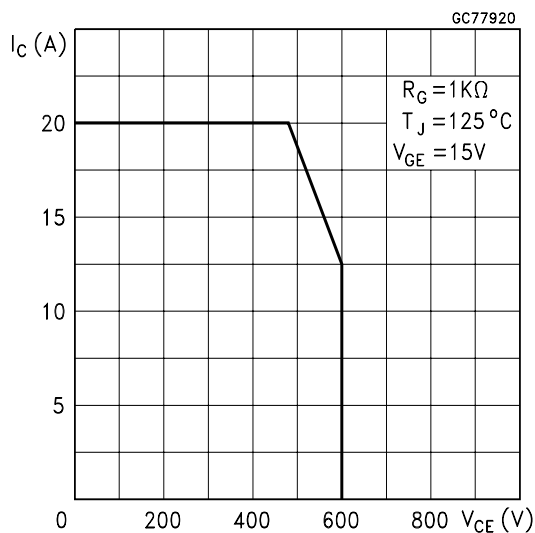
Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$I_f$	Forward Current				7	A
$I_{fm}$	Forward Current pulsed				56	A
$V_f$	Forward On-Voltage	$I_f = 3.5\text{ A}$ $I_f = 3.5\text{ A}$ , $T_j = 125\text{ }^\circ\text{C}$		1.4 1.15	1.9	V V
$t_{rr}$	Reverse Recovery Time	$I_f = 7\text{ A}$ , $V_R = 20\text{ V}$ , $T_j = 125\text{ }^\circ\text{C}$ , $di/dt = 100\text{ A}/\mu\text{s}$		50		ns
$Q_{rr}$	Reverse Recovery Charge			70		nC
$I_{rrm}$	Reverse Recovery Current			2.7		A

(●) Pulsed: Pulse duration = 300  $\mu\text{s}$ , duty cycle 1.5 %.

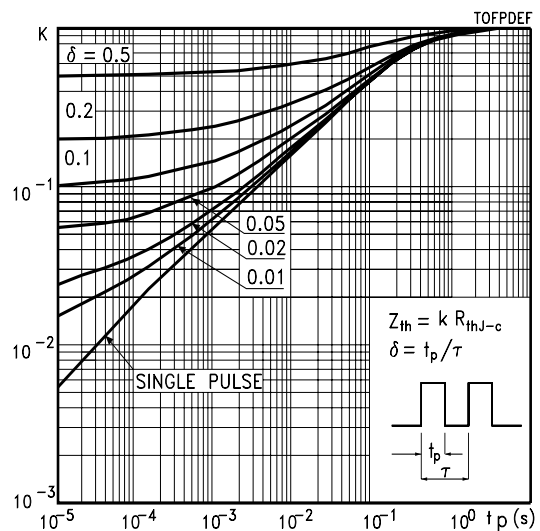
(1) Pulse width limited by max. junction temperature.

(\*\*) Losses Include Also the Tail

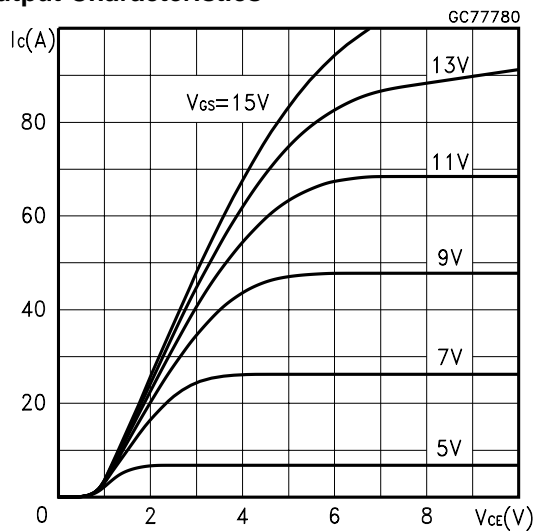
## Switching Off Safe Operating Area



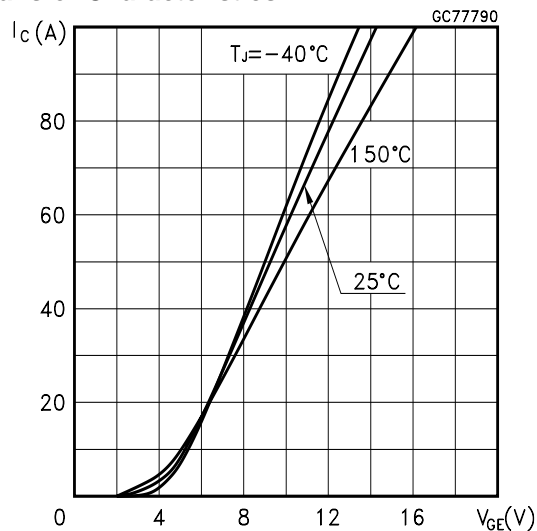
## Thermal Impedance



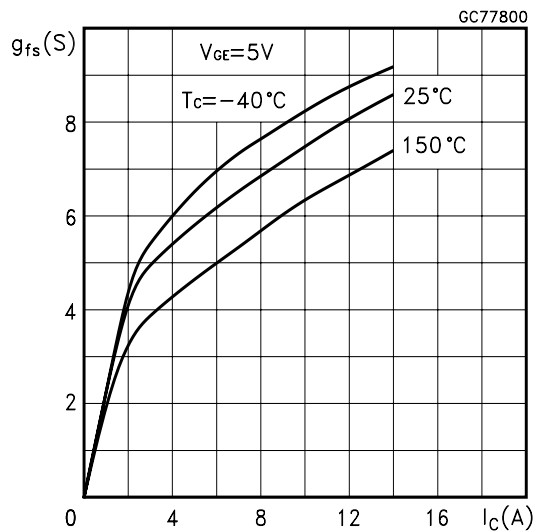
### Output Characteristics



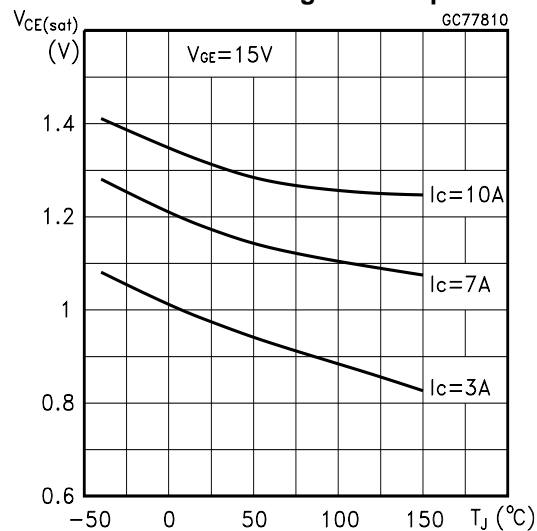
### Transfer Characteristics



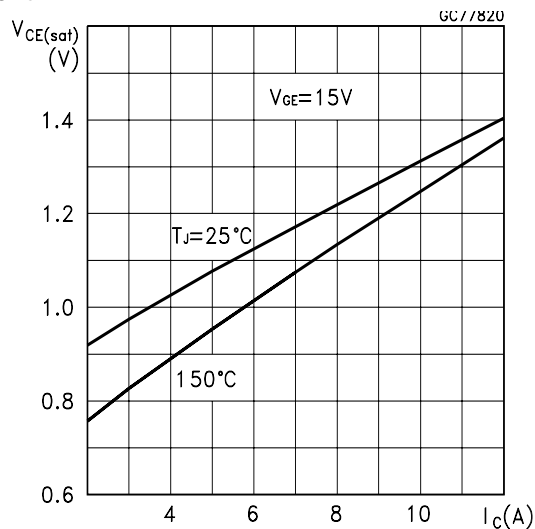
### Transconductance



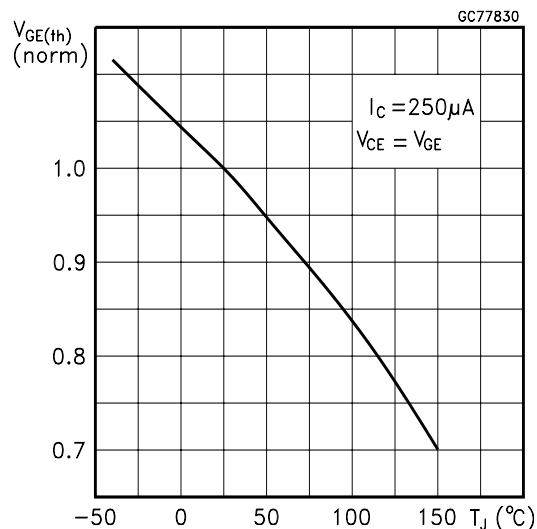
### Collector-Emitter On Voltage vs Temperature



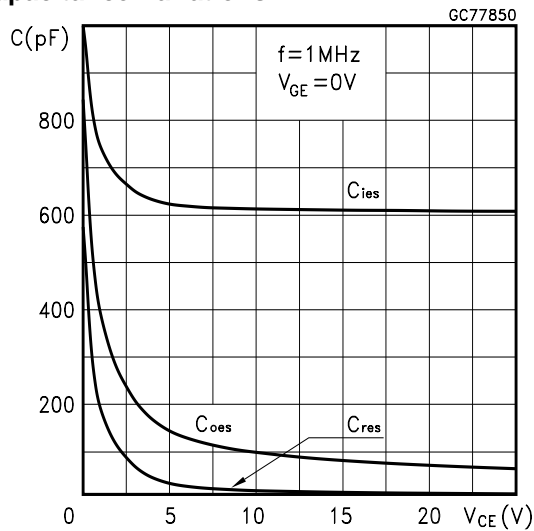
### Collector-Emitter On Voltage vs Collector Current



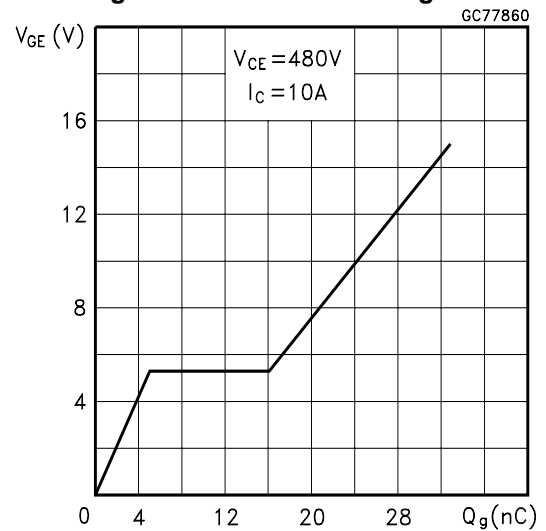
### Gate Threshold Voltage vs Temperature



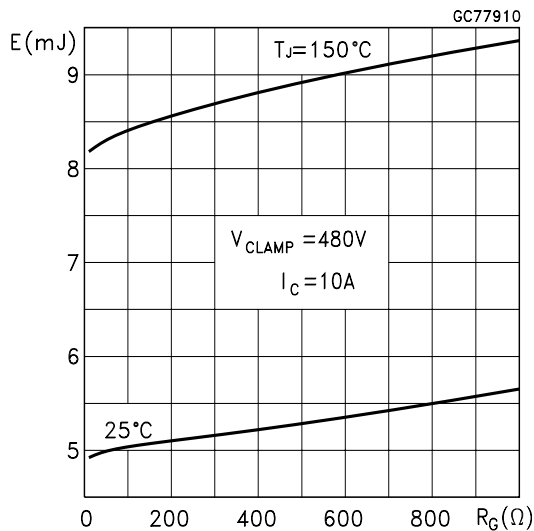
### Capacitance Variations



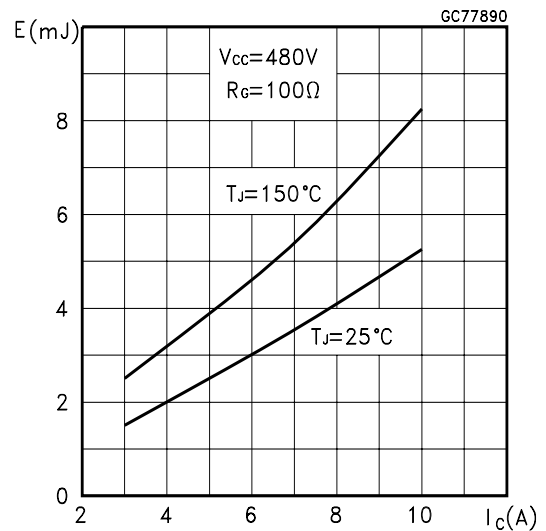
### Gate Charge vs Gate-Emitter Voltage



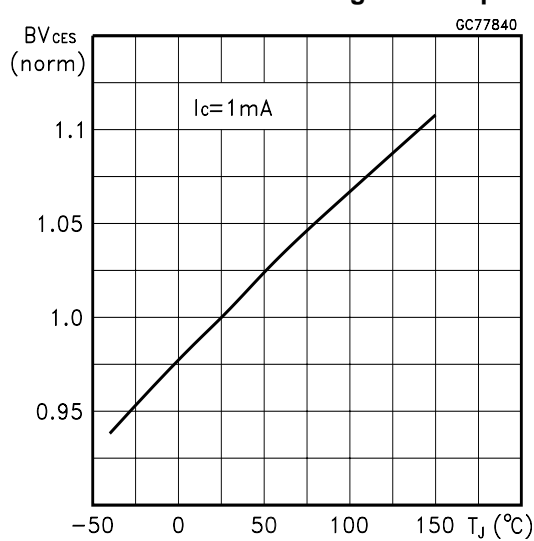
### Off Losses vs Gate Resistance



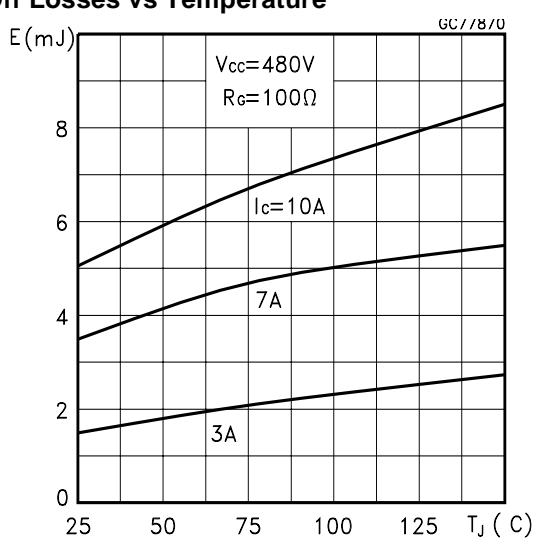
### Off Losses vs Collector Current



### Normalized Break-down Voltage vs Temp.



### Off Losses vs Temperature



Emitter-Collector Diode Characteristics

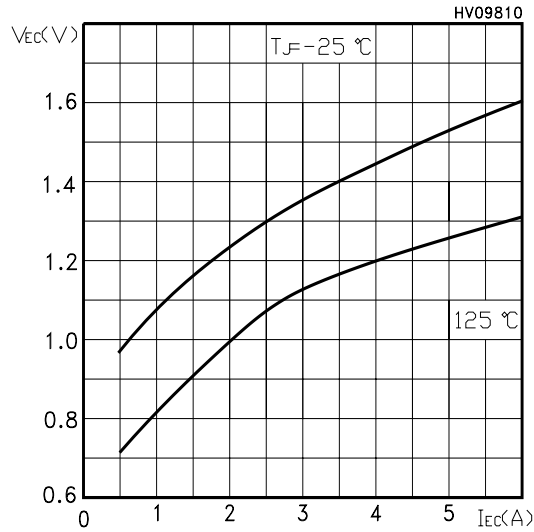


Fig. 1: Gate Charge test Circuit

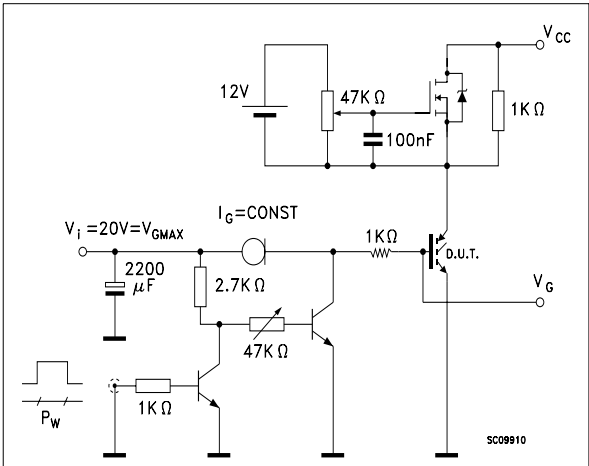
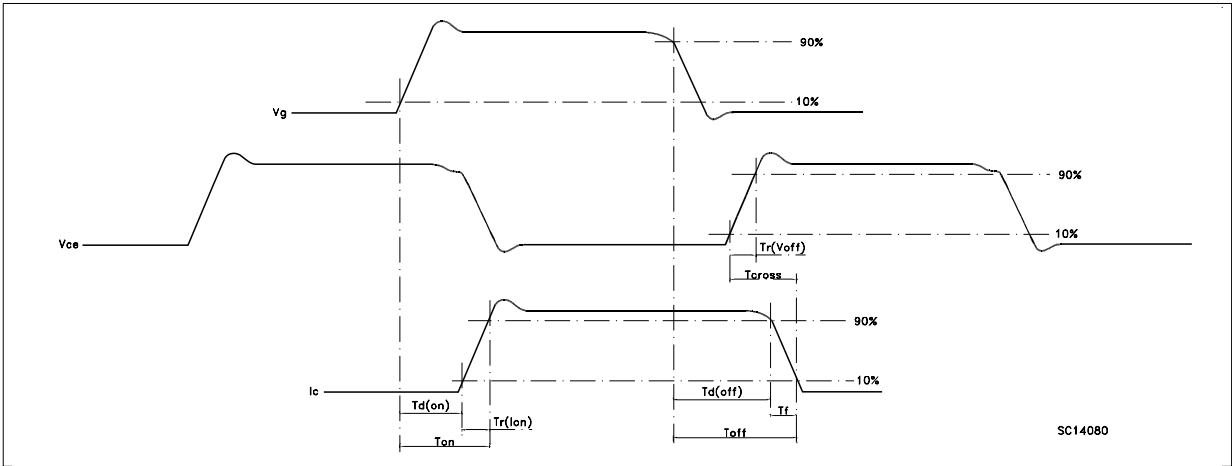
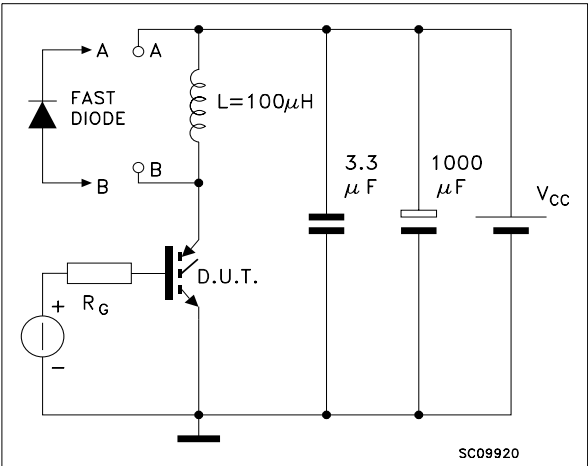
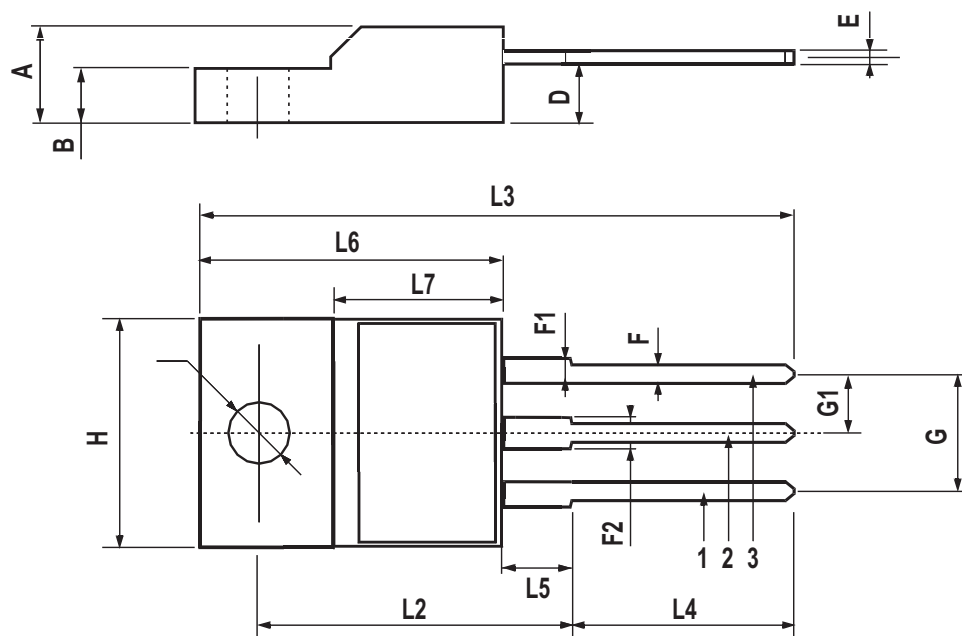


Fig. 2: Test Circuit For Inductive Load Switching



## TO-220FP MECHANICAL DATA

DIM.	mm.			inch		
	MIN.	TYP	MAX.	MIN.	TYP.	MAX.
A	4.4		4.6	0.173		0.181
B	2.5		2.7	0.098		0.106
D	2.5		2.75	0.098		0.108
E	0.45		0.7	0.017		0.027
F	0.75		1	0.030		0.039
F1	1.15		1.5	0.045		0.067
F2	1.15		1.5	0.045		0.067
G	4.95		5.2	0.195		0.204
G1	2.4		2.7	0.094		0.106
H	10		10.4	0.393		0.409
L2		16			0.630	
L3	28.6		30.6	1.126		1.204
L4	9.8		10.6	.0385		0.417
L5	2.9		3.6	0.114		0.141
L6	15.9		16.4	0.626		0.645
L7	9		9.3	0.354		0.366
Ø	3		3.2	0.118		0.126



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